Modelling Methods for Trade Policy

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1. Why do we need a model for trade policy?
2. Modelling Approaches:
   a. Ex-ante/Ex-post Analysis
   b. Static/Dynamic
   c. Partial/General Equilibrium Models
3. Computable General Equilibrium Model
4. GTAP as a CGE example
5. Gravity Models
6. Case Studies
1. Why do we need a model for trade policy?

• to provide a theoretically consistent, rigorous and quantitative way to evaluate different economic policies

• to confirm a policymaker judgement or alert him over unintended consequences

• estimations/simulations and policymaker own insights should be COMPLEMENT in the formation and conduct of policy making
2a. Modelling Approach

- *Ex-Ante* analysis: simulate the (future) impact of alternative trade policies
  (simulations using PE/GE model)

- *Ex-Post* analysis: quantify the effects of past trade policies
  (all econometric analysis)

*Both approaches can answer the question: “what if ... ?”*
2b. Modelling Approach

• *Comparative Static Analysis*: compare initial and final steady-state
  - more simple (theoretically, computationally)

• *Dynamic Analysis*: also looks at the evolution from the initial to the final equilibrium. They capture:
  - adjustment process
  - capital accumulation
  - technological changes
2c. Partial Equilibrium Models (PE)

- Focus on one sector at time
- Neglect interactions between markets
- Useful if second-order effects are likely to be small
- Advantages:
  - Simple models
  - Transparent (as rely on few key parameters)
  - Add realism in the specific sector
PE Ex.: removal of tariff on wheat

Gains from liberalization: Freeing up resources to employ them more efficiently
PE graphical representation: removal of a tariff on wheat

- Initially $p_h = p_w(1 + \tau)$
2c. General Equilibrium Models (GE)

IMPORTANT: Take into account linkages between markets, both product and factor markets (including feedback to the original market)
GE Ex.: removal of tariff on wheat

P(wheat) falls

- D(wheat) up (price elasticity)
- D(butter) up (degree of complementarity)
- D(rice) down (elasticity of substitution)

Q(wheat) down (elasticity of supply)

M(wheat) up

- Land, capital, labour out of wheat into butter

• Income effect spread to other markets
• Gains derive from freeing up resources for more efficient use
Production possibility frontier, two factors of production (labour intensive country)
GE equilibrium assumptions

1. Underlying optimazing behaviour of economic agents (households and firms) generate demand and supply curves

2. In each market: demand=domestic supply + foreign supply

3. Overall, total receipts= total payments
Circular Flow: closed economy

Households

Savings

Factor services of production

Factor incomes

Firms

Capital goods

Investment

spending on goods and services

goods and services
3a. Computable General Equilibrium Models (CGE)...what are they for?

- CGE is a GE model that use the power of today computers to calculate NUMERICALLY the effects of changes in exogenous and/or policy variables, in setting with many goods and factors and countries.

- CGE provide a precise numerical answer to the question “what is the impact of .....(a numerically specified trade policy)?”
3b. Operationalizing a CGE model ...i) assumptions

Introduce **assumptions** on

- market structure (im/perfect competition)
- production function (two-level)
- representative household max behaviour
- government behaviour
- substitutability between domestic and foreign products (Armington assumption)
- Investment and dynamics
- Model closure (unemployment?)
- Social Welfare = Welfare of the representative household
3b. Operationalizing a CGE model

...ii) Social accounting matrix

- SAM provide CGE with the data
- SAM builds on the circular flow
- Uses info on I-O tables, national accounts, government fiscal account, trade data
- Need to be collected, standardized (same base year and currency) and combined
3b. Operationalizing a CGE model

iii) elasticities

- substitution between factor of productions
- household price elasticities of demand
- Household income elasticity
- substitution between domestic and foreign products (Armington elasticities)

IMPORTANT: PE and GE approach are complementary. In many cases (e.g. in GTAP), CGE models borrows parameter estimates from PE econometric studies
3b. Operationalizing a CGE model

iv) calibration

- Calculate a subset of parameters that together with the SAM and inputed values for the elasticities can replicate the data of the reference year (baseline)
3c. CGE ...desirable features

If policy models need to be used in policy debate, they need:

• policy relevance
• transparency
• timeliness
• validation and evaluation
• diversity of approaches.
4. A CGE Model: GTAP

- Multi-region model (Policy Relevance)
  - GATT/WTO multilateral liberalization
  - Regional Trading Blocks
  - Environmental Policy

- Global database (Timeless)
  - Input-output data
  - Bilateral trade flow data
  - Bilateral duty collection data
  - 57 commodities in 87 regions

- Standard modeling framework (Transparency)

- Global network of researchers (Evaluation and Validation, Diversity of Approaches to some extent)
4a. GTAP ... Standard Structure

- Perfect competition and CRS (resources fully employed)
- Armington assumption: goods are differentiated by country of origin
- Static
- Explicit treatment of international trade and transport margins (global transport sector)
- No direct link between public expenditure and taxes
- Global Banking sector
4b. GTAP...limitations

- Some sectors in some countries could be characterized by imperfect competition and economies of scale

- Armington assumption does not allow for the relocation of firms

- Absence of the variety effect

- The use of a global banking sector is due to the lack of bilateral investment and ownership data
  - No specific treatment of domestic vs. foreign investment
  - Only a small proportion of domestic savings will return to a region as investment

- Not appropriate to look at issues related to the composition of public expenditures

- Labor market issues cannot be dealt with properly

However, some of the assumptions can be relaxed/modified (Diversity of Approaches)
5. Gravity Models

- Econometric model (ex-post analysis)
- Specification similar to Newton’s Law

\[
F_{ij} = K \frac{M_i^\alpha M_j^\beta}{D_{ij}^\theta}
\]

M = Size (GDP, POP)  D = distance
5a. Gravity Model: Theoretical foundation

• reduced form of a intra-industry trade model

\[
F_{ij} = \frac{M_i M_j}{M_w} \left( \frac{T_{ij}}{P_i P_j} \right)^{1-\sigma}
\]

\( P = \) Resistances (trade weighted average distances from the rest of the world)

5a. Estimated gravity equation...

...Normal Trade

- Normal trade

\[ \ln (\text{Trade}_{ij}) = \ln \alpha \ln(\text{GDP}_j) + \beta \ln(\text{GDP}_j) + \theta \ln(\text{distance}_{ij}) + \text{fixed effects } i \text{ and } j + u_{ij} \]
5b. “Augmenting” the gravity equations

- Income per capita (higher income countries trade more)
- Adjacency
- Common language, colonial links
- Institutions, infrastructures, labour flows,...
- Surprisingly, bilateral tariff barriers often missing!!!
5b. “Augmenting” gravity model

• To evaluate the impact of RTAs: Trade creation and trade diversion

\[ \ln(\text{Trade}_{ij}) = \alpha \ln(\text{GDP}_i) + \beta \ln(\text{GDP}_j) + \]
+\(\theta\) ln(distance\(_{ij}\), adjacency, language ..) + \(\rho\) (fixed effects \(i\) and \(j\)) + \(\phi\) (intra-RTA) + \(\chi\) (extra-RTA) + \(u_{ij}\)

• **IMPORTANT** the gravity model does not estimate welfare effects
6. Case Studies

- Describe the experience of a specific country case/ specific industry
- Analysis of the facts without a single, rigorous working framework
- Often the only tool for lack of data
- Difficult to generalize
7. What have we learned?  
An Application: Regionalism

- Partial Equilibrium Model
- Computable General Equilibrium Model (GTAP)
- Gravity Model
PE of the formation of a RTA

H is small. Initial MFN tariff = t. H and P form a CU. W is the least-cost source of foreign supply of wheat.